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SeismoGeodesy: Combination of High Rate, Real-time GNSS and Accelerometer Observations and Rapid Seismic Event Notification for Earth Quake Early Warning and Volcano Monitoring

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Scientific GNSS networks are moving towards a model of real-time data acquisition, epoch-by-epoch storage integrity, and on-board real-time position and displacement calculations. This new paradigm allows the integration of real-time, high-rate GNSS displacement information with acceleration and velocity data to create very high-rate displacement records. The mating of these two instruments allows the creation of a new, very high-rate (200 Hz) displacement observable that has the full-scale displacement characteristics of GNSS and high-precision dynamic motions of seismic technologies. It is envisioned that these new observables can be used for earthquake early warning studies, volcano monitoring, and critical infrastructure monitoring applications.

Our presentation will focus on the characteristics of GNSS, seismic, and strong motion sensors in high dynamic environments, including historic earthquakes replicated on a shake table over a range of displacements and frequencies. We will explore the optimum integration of these sensors from a filtering perspective including simple harmonic impulses over varying frequencies and amplitudes and under the dynamic conditions of various earthquake scenarios. We will also explore the tradeoffs between various GNSS processing schemes including real-time precise point positioning (PPP) and real-time kinematic (RTK) as applied to seismogeodesy. In addition we will discuss implementation of a Rapid Seismic Event Notification System that provides quick delivery of digital data from seismic stations to the acquisition and processing center and a full data integrity model for real-time earthquake notification that provides warning prior to significant ground shaking.